

Title: Surf 'N Turf within Geometry

Link to Outcomes:

- **Patterns and Relationships** Students will determine the relationship between linear measure and area of similar figures.
- **Cooperation** Students will design a garden using certain specification requirements.
- **Communication** Students will discuss the project within their group, to their Internet penpals, and to their class.
- **Technology** Students will use the Internet and/or World Wide Web to communicate and perform research. Students will use *The Geometer's Sketchpad*[™] or *The Geometric Supposer*[™].
- **Problem Solving** Students will develop critical thinking skills as they approach problems by using various strategies.
- **Measurement** Students will measure both the scale drawings and the landscape design.
- **Algebra** Students will use ratios and proportions to plan scale drawings from landscape design dimensions.
- **Geometry** Students will apply knowledge of terms and concepts such as similarity, area, properties of polygons, and measurement.

Brief Overview:

Students will receive information by using electronic mail to discuss plot dimensions and garden requirements. Students will then use the properties of polygons, area, perimeter, and similarity to design an appropriate garden. They will make a detailed plan including types and number of plants, mulch, or other landscaping trim. The plan will be complete with cost estimates simulating a professional landscape service. All designs will be sent (via regular U.S. mail) to the client class. The receiving group will select a final proposal, and then, it could construct a garden using the final proposal. A biology or other appropriate class could assist with aspects of the project.

Grade/Level:

Grades 9-12: Geometry (interdiscipline connection to Art, Biology, Business, or Horticulture).

Duration/Length:

Approximately 10 to 25 hours of class time spread out over the duration of the course.

Prerequisite Knowledge:

- Basic geometric terminology.
- General constructions and measurement drawings such as circles, perpendicular line segments, scaled polygons, parallel line segments, angles, and angle bisectors.
- Knowledge of ratios and proportions.

Objectives:

Students will

- develop global communication skills through Internet communication and information retrieval via the Internet and/or World Wide Web.
- develop an appreciation for real-life applications of various geometry concepts.
- use and understand concepts of similarity, area, perimeter, properties of polygons, circles, constructions, measurement, and solid geometry.
- develop cooperative learning skills and techniques through their local group and interschool communication.

Materials/Resources/Printed Materials:

NOTE: Many of these materials are merely suggestions and can include, but should not be limited, to the following:

TEXTS

- Ellsworth, Jill H. Education on the Internet, SAMS Publishing, Indianapolis, Indiana. 1994.
- Krol, Ed. The Whole Internet, O'Reily & Associates, Inc. Sebastopol, CA. (800-998-9938). 1993.
- Sandler, Corey & Baddgett, Tom. Welcome to...Internet: From Mystery to Mastery. MIS: Press, NY, NY. 1993.
- Va's Space Grant Consortium. The Educator's Guide to the Internet. Hampton, VA (804-865-0726). 1994.

STUDENT SOURCE

Boe, Tom. World Desk: A Student Handbook to Gopher and the World Wide Web. Learning in Motion, Santa Cruz, CA. 1995.

VIDEO

“Global Quest: The Internet in the Classroom.” Produced by NASA Ames Research Center.

PROFESSIONAL DEVELOPMENT RESOURCE TEXTS

Futrell, Mynga K. & Geisert, Paul G. Teachers, Computers, and Curriculum, 2nd Ed. Allyn and Bacon, Needham Heights, Mass. 1995.

Jaffe, Lee David. Introducing the Internet Plus: A Trainer’s Workshop. Library Solutions Press, Berkeley, CA. 1994. (Includes both Windows and Macintosh disks of presentation slides).

NCTM. Assessment Standards for School Mathematics. NCTM, Reston, VA. 1995.

SOFTWARE

“The Geometer’s Sketchpad.”

“Geometric Supposer” (or “Super Supposer”)

PC Connection. FLOWERScape. [Garden design program.\$50] Comes in both Macintosh and Windows version. (1-800-800-1111).

Moon Own Software. Garden in Time [Garden design program. \$49.95] (1-800-228-0705).

Terrace Software. Mum’s the Word Plus [For the Macintosh.] (617-396-0382).

LOCAL AND USENET NEWSGROUPS VIA INTERNET

va.pen.math-science

k12.sys.projects

k12.ed.math

nptn.academy.msn.projects

alt.planning.urban

alt.architecture

rec.gardens

WWW RESOURCES

Pete's Pond Page

<http://reality.sgi.com/employees/peteo/>

Similarity, Rotation and Symmetry 'games'

<http://www.geom.umn.edu/bin/unifweb/about.html/>

Mayes & Meanders

http://www.geom.umn.edu/pix/archive/homepage/combinatorics_meander.html

Spacelink

<http://spacelink.msfc.nasa.gov>

On-Line Botanical Gardens

<http://www.btw.com/urls/toc.html>

University of Delaware Botanical Garden

<http://bluehen.ags.udel.edu/udgarden.html>

Development/Procedures:

Pre-Unit Activities

- Request approval for interdisciplinary unit.
- Acquire necessary materials.
- Introductory activities which could include any of the following:
 1. Picture presentation of local or famous gardens
 2. Outside speaker(s) from the areas of horticulture, landscaping design, other teachers from any related discipline (i.e. Biology, Horticulture, or Art), local historian, or a garden club member
 3. Foray into the World Wide Web with a Topic Search
 4. Field trip to a local garden or a related business
- Preliminary and ongoing activities concentrating on basic scale drawings through individual, hands-on, and group activities
- Communication with client and consulting classes will begin with e-mail transmissions of introductions and garden specifications.
- Completion of guided exercises
- Students will maintain a log of activities and impressions.
- Cooperative planning of scale garden design
- Students will communicate final plans to the client class which will select its favorite.
- Students will construct garden from the selected plan.

- Follow-up to include final journal writings and transmission of pictures to consulting class of final project results.

Activities And Projects

Preliminary Activity

Directed activity using pencil, paper, and construction tools to get the thinking for the project started

Activity One

Directed activity utilizing pencil, paper, and construction tools to simulate elements of the final project

Activity Two

Use computer software to demonstrate various components of the project.

Activity Three

A guided partner assignment where students act as client/consultant to each other

Activity Four

Client and consultant classes need to begin Internet communication via e-mail.

Activity Five

Consultation of experts and use of library, Internet, and/or WWW to conduct research

Activity Six

Preparation, organization, and completion of final project

Evaluation:

- Evaluation of Student Preliminary Activity Sheets
- Group Self Evaluation
- Journal Writings Checked Periodically
- Group Project Evaluation
 - Research on location and plants
 - Evaluation of specification requirements
 - Mathematical
 - Artistic placement
 - Viability
 - Creativity as judged by client class
 - Aesthetic appearance as judged by client class
- Final Journal Evaluation

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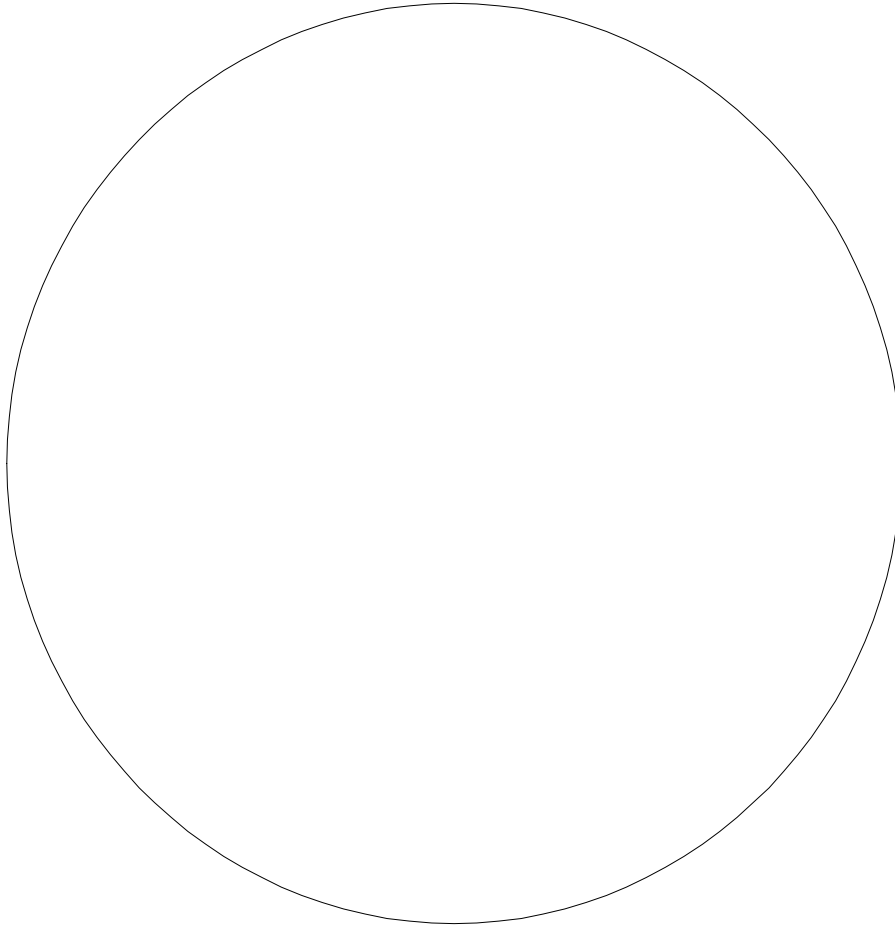
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INTRODUCTORY ACTIVITY

- I. Students at the high school are working on a service project for their school. They will be developing a garden surrounding the flag pole on a level area on the south side of the school.

The circular region around the flagpole has a 10' radius.

Find the center of the circle.



1 inch to 4 feet scale factor

Construct a Square inscribed in the circle.

1. Draw a diameter AC.
2. Construct perpendicular segment to the diameter at the center. Find the intersections of the perpendicular segment with the circle. Label points B and D.
3. Draw the square ABCD.
4. What property of a square is used?
5. What other quads have this property?

Find the corresponding measurements (round to the nearest tenth):

OA	AB	BC	CD	DA	AC	BD	$\angle AOB$	$\angle DAB$	P(ABCD)	A(ABCD)	A(O)

On the top row of boxes, place the measurement of the model, and on the bottom row of boxes, calculate the actual measurements of the physical implementation.

Conjectures:

State relationship between scale factor and linear measure.

State relationship between scale factor and area.

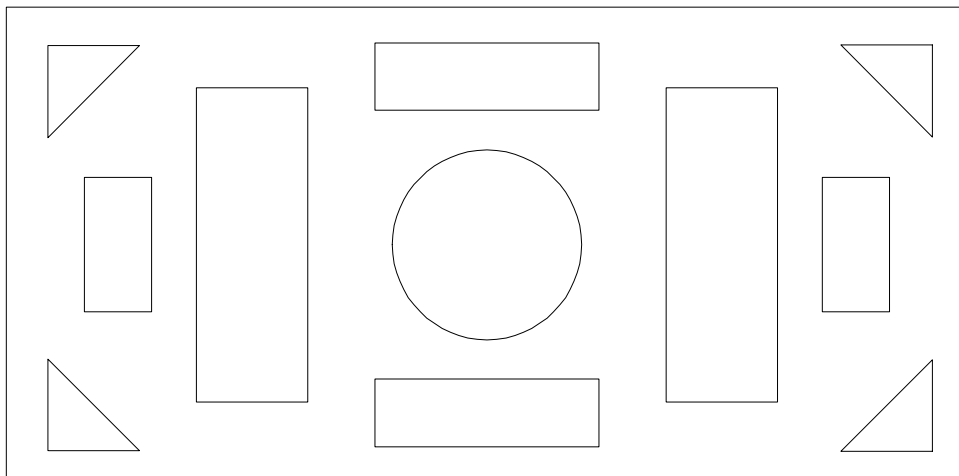
II. Students at the high school are also planning to develop a new planted area at their school. They want to have a triangular garden area which has an area of 42 square feet.

1. Find dimensions of a triangle which will have this area.
2. Construct a triangle to scale and indicate $1 \text{ cm} = \underline{\hspace{2cm}}$.
So that the triangle will be drawn to scale, fit in the space and have the stated area.
3. Draw your triangle here:
4. What is the scale factor? $\underline{\hspace{3cm}}$
5. Measure the angles in the triangle.
6. Do the angles of the triangles measure the same or different from other students' in the class.
7. Calculate the area of the scale Triangle.
What is the multiplier needed to arrive at the area 42?
8. Explain the relationship between the linear measurements of similar figures.
9. Explain the relationship between areas of similar figures.

ACTIVITY ONE

In this activity you will use pencil, paper, compass, and protractor to construct a simple garden arrangement. Below are the specifications for the garden. Construct the 'best use of space' solution within the specified guidelines.

The plot measures 9 feet by 15 feet and will contain four triangular beds, one circular bed, and six rectangular beds of flowers. Note that the remaining area will be mulched. Remember to construct the 'best use of space' garden that fits within these specifications. The scale is one inch to three feet. What follows is **one** solution. Complete another solution on the attached sheet and answer the follow-up questions as they pertain to that completed solution.



Follow-up questions (round all area answers to the nearest tenth):

1. What is the total area of the rectangular beds?
2. What is the area of the circular bed?
3. What is the total area of the triangular beds?
4. What is the total area to be mulched?

One bag of mulch will cover 5 square feet, costs \$1.99, and has a sales tax of 4.5%.

5. How many bags must be purchased to mulch the garden.
6. Find the cost.

ACTIVITY TWO

In this activity, use the *Geometric Supposer*[™] or the *Geometer's Sketchpad*[™]. Work with your assigned partner. Below are the specifications for a simple garden. Using computer software, construct the 'best fit' arrangements within the specific guidelines.

The plot dimensions are 16 feet by 22 feet, and will contain three triangular beds, two circular beds, one hexagonal bed, and 8 rectangular beds of flowers. The remaining area will be mulched. Please construct the 'best use of space' garden. The scale is one inch to two feet. Print the solution and attach the answers to the follow-up questions as they pertain to the completed solution.

Follow-up questions (round area answers to the nearest tenth):

1. What is the total area of the rectangular beds?
2. What is the total area of the circular beds?
3. What is the total area of the triangular beds?
4. What is the area of the hexagonal bed?
5. What is the total area to be mulched?

One bag of mulch will cover 4 square feet, costs \$2.19, and has sales tax of 4.5%.

6. How many bags must be purchased to mulch the garden?
7. Find the cost?

ACTIVITY THREE

In this activity, act as the consultant to the partner/client. Use pencil, paper, compass, and protractor to construct a simple garden arrangement which will meet the specification stated by the client. Each student will complete a design, summarize resulting statistics, and provide follow-up (i.e. A client is not completely happy with the design. Continue with modifications until the customer is satisfied.).

Each specification must contain a minimum of 4 different shapes. A scale factor must be included with the design, and total areas should be stated.

ACTIVITY FOUR-ONE

Today is an incredibly exciting day!! Begin communicating with the client and consulting classes. Prepare a very **SHORT** bio for the lead typist to e-mail to the corresponding schools. The bio should include name, age, and an area of interest.

ACTIVITY FOUR-TWO

The class will soon be sending garden specifications to the consulting class. In groups, discuss optimal use of the space available and the basic shapes and contents to be used. Bring group ideas back, and continue with a class discussion to finalize specifications and details.

ACTIVITY FIVE

This activity can allow the student to hear a speaker(s) present ideas on landscaping, plant selection, optimal use of space available, and aesthetic value. Students need to begin consideration of appropriate plant and flower selection for client's environment. Use of the library and/or Internet resources would be appropriate at this point.

ACTIVITY SIX

Students will work at convenient times to prepare, organize, and complete their projects. Each final project should include a scale drawing, a scale, and suggestions for plant/flower selection, aesthetic placement, and future additions.

ACTIVITY SEVEN

1. Students will be given a budget and research price lists and must complete the project based on best allocation of resources such as viability, cost restrictions, and client requests.
2. Students could be presented with future developments and wanted changes and asked how they would modify these designs.
3. Students could be asked to complete future maintenance proposals, including schedule of tasks with cost estimates for one year.

FINAL PRESENTATIONS

Final presentations will be mailed to the client class which will evaluate them on the following five-point scales:

- Specification Requirements Met 0 - 5
- Placement and Viability 0 - 5
- Creativity 0 - 5
- Aesthetic Appearance 0 - 5

The consultant class will receive all evaluation reports and notification of the winning design.

Client class will send consultant class pictures and a final evaluation of resulting garden.